NASA

Technical Memorandum 85015

COSPAS-SARSAT SATELLITE ORBIT PREDICTOR VOLUME III

(NASA-TM-85015-Vol-3) COSPAS-SARSAT SATELLITE ORBIT PREDICTOR, VCIUME 3 (NASA) 58 p CSCL 22B N87-17813

Unclas 43275

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APRIL 1984

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Cospas-Sarsat Satellite Orbit Predictor Volume III

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Scientific and Technical Information Branch

1984

THIS ALMANAC COVERS THE PERIOD APRIL 15, 1984, THROUGH OCTOBER 15, 1984, AND WILL BE REPLACED PERIODICALLY.

SATELLITE ORBIT PREDICTOR

The satellite orbit predictor is a graphical aid for determining the relationship between the satellite (SARSAT or COSPAS) orbit, antenna coverage of the spacecraft and coverage of the LUTs. The predictor allows the user to quickly visualize if a selected position will probably be detected and is composed of a base map and a satellite track overlay for each satellite. Additionally, a table of equator crossings for each satellite is included.

In order for a LUT to receive ELT/EPIRB information from a satellite, mutual visibility between the satellite, LUT and ELT/EPIRB must occur. Mutual visibility requires two simultaneous conditions:

- a. The satellite subtrack or ground track must lie within a LUT coverage circle for at least 4 minutes.
- b. and the suspected ELT/EPIRB must lie within the satellite antenna coverage swath during the 4 minute period.

The base map is a polar stereographic projection of the northern hemisphere. The LUT coverage circles are based on the LUT seeing the satellite at the horizon. On projections of this type equal increments of latitude are not equidistant. Therefore, the map includes a dot matrix in the ocean areas with the dots printed as a one degree latitude by one degree longitude field. Another property of the projection is that the center of the LUT coverage does not coincide with the actual geographical position of the LUT.

The overlay shows the satellite ground track or subtrack (black) starting from the ascending node (northbound equator crossing) and continuing minute by minute across the overlay. In addition, the 10 degree coverage limits of the spacecraft antenna (red) are plotted on both sides of the subtrack. The yellow lines connecting the antenna coverage swath and the subtrack indicate time in minutes. Just to the west of the left hand antenna coverage limit is a short line segment (labeled "next pass") which is the index for the next ascending node equator crossing.

The table of satellite equator crossings contains the zulu date/time group that a satellite will cross the equator northbound, the orbit number, and the longitude that it will cross the equator. A particular orbit starts when the satellite crosses the equator northbound (ascending) and ends just prior to the next ascending node equator crossing. The longitudes are listed in degrees east longitude, i.e., a negative number in this column is a west longitude.

To use the predictor, first select an equator crossing from the table and then rotate the satellite overlay to position the satellite subtrack over the selected equator crossing longitude. The predictor now represents the satellite ground track for the selected orbit. Subsequent and previous orbit depictions can be obtained by using the "next pass" index.

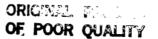
For subsequent orbits... mark or note the longitude beneath the "next pass" index and rotate the overlay clockwise to position the satellite subtrack over the new equator crossing longitude. For previous orbits, rotate the overlay counterclockwise to position the "next pass" index over the present equator crossing. The ground track for the previous pass will be to the right of the original orbit, and the subtrack for subsequent orbits will be to the left of the original equator crossing. One can do this all the way around the wheel without sacrificing a great deal of accuracy.

So far we have just looked at positioning the overlay to obtain a depiction of a satellite ground track for a selected orbit number and then ground tracks for later and earlier orbits. Now let's examine what information we can get from the depiction. When the subtrack intersects a LUT coverage circle, the LUT will receive signals from the satellite for the time period that the subtrack is within a coverage circle. An ELT/EPIRB is visible to the satellite when it lies within the antenna coverage limits (red lines). Mutual visibility occurs when an ELT/EPIRB is within the satellites field-of-view at the same time that the satellite subtrack lies within a LUT coverage circle. From this, we can see for a selected orbit if a spacecraft will be seen by a LUT and approximately where ELTs/EPIRBs must be located to be processed by a LUT. The predictor can be used for more sophisticated problems such as approximate AOS and LOS at a LUT, next time an ELT/EPIRB will be in mutual visibility, and when/if an area of interest will be seen by a satellite and a LUT.

To determine approximate AOS and LOS at a LUT, refer to the equator crossing table and note the time (in zulu) that the satellite will cross the equator. Next, position the overlay as previously discussed and count the yellow lines from the equator to the point at which the subtrack intersects the LUT coverage circle. Add the number of minutes to the time of equator crossing and you have the approximate AOS. Continue counting the yellow lines until the subtrack exits the LUT circle and add them to the AOS time and you have the approximate LOS as well as the approximate duration of the pass. (See example 1.)

Finding out when the next time an ELT/EPIRB will be in mutual visibility of the satellite and LUT is simply a combination of the above two tasks. From the original orbit, move the overlay clockwise orbit-by-orbit using the "next pass" index until mutual visibility is established and then reference the equator crossing table for the time of equator crossing using the longitude now under the ascending node. By counting the minutes since equator crossing and adding them to the time of equator crossing, one comes up with the approximate time the ELT/EPIRB will next be in mutual visibility. (See example 2.)

Using the orbit predictor to determine when and if an area of interest will be viewed by the satellite and the LUT is a bit more complicated. First, locate the area of interest on the base map, refer to the equator crossing table for a longitude within plus or minus 20 degrees that has an equator crossing time within the appropriate time frame, position the overlay at the selected longitude and determine if mutual visibility will exist. (See example 3.) If there is not mutual visibility on that orbit, rotate the overlay using the "next pass" index until you determine that mutual visibility exists or that the interest area is too distant from a LUT or the satellite subtrack for mutual visibility to exist.



EXAMPLE NO. 1

1. Refer to the equator crossing table for time and longitude of the desired equator crossing:

TIME (GMT)	E. LONGITUDE	ORBIT
day hr mn sc	deg.dg	
292 9 32 4	19.94	1523
292 11 17 26	-6.52	1524
292 13 2 48	-32.99	1525
292 14 48 9	-59.45	1526 <
292 16 33 31	-85.92	1527
292 18 18 52	-112.38	1528

From the equator crossing table, select orbit number 1526. The zulu date/time group for the equator crossing is 292 (19 Oct) 1448:09. The longitude of the equator crossing is 59.45 W.

2. Position the overlay so the subtrack coincides with the northbound equator crossing and then count the number of yellow lines (minutes) from equator crossing to the point where the subtrack enters a LUT circle (AOS) and exits a LUT circle (LOS).

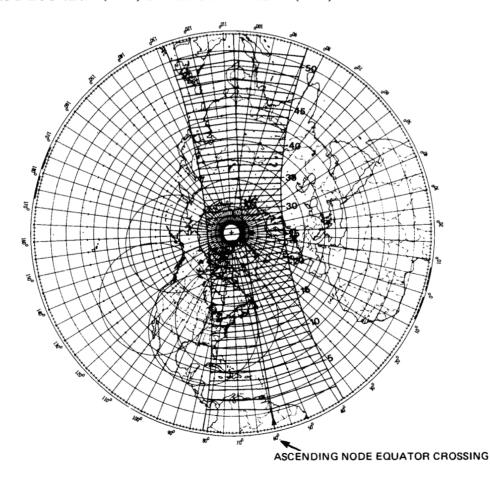


Figure 1

Position the overlay so the ascending node is set at 59.45 W. Now count the number of yellow lines from the equator until the subtrack intersects a LUT circle. In this case the subtrack intersects a lut circle 5 minutes after crossing the equator, the subtrack lies within the LUT circle for 14 minutes before exiting. Adding these times to the equator crossing time of 1448:09 yields an approximate AOS of 1453:09 and an approximate LOS of 1504:09.

EXAMPLE NO. 2

1. From the original orbit move the overlay clockwise using the "next pass" index until mutual visibility is established.

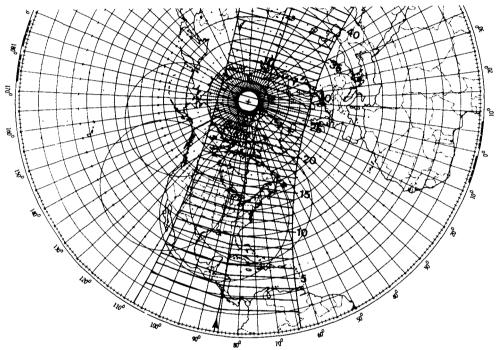


Figure 2

Assume there is an ELT located at 40 00.0 N. and 080 00.0 W. The original orbit (1526) is within mutual visibility, and we want to know the next time the ELT will be in mutual visibility. The "next pass" index is at approximately 087 W. rotate the overlay until the subtrack coincides with 087 W.

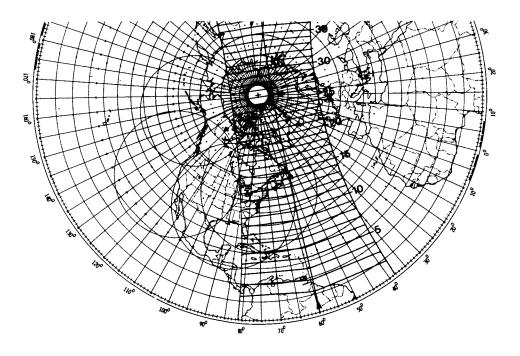


Figure 3

By looking at the subtrack and LUT circle, we see that the satellite will see the ELT and LUT on the next orbit (#1528). Adding the times to the equator crossing time (1633:31) gives us an approximate AOS of 1637, a 16 minute pass with an approximate LOS of 1653.

EXAMPLE NO. 3

SCENARIO: Assume you are interested in using the SARSAT system to locate the possible wreckage of a light aircraft that departed Charleston, South Carolina, enroute to Roanoke, Virginia. The aircraft departed Charleston at 1300Z on 19 October 1982 and never reached Roanoke.

1. Locate the route of flight or suspected ELT/EPIRB position on the base map and note the approximate longitude.

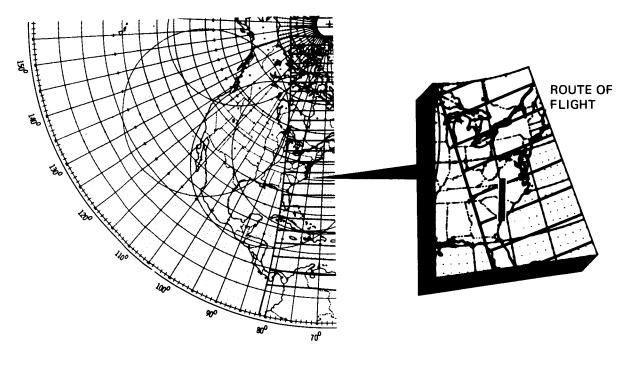


Figure 4

The route of flight is marked in the expanded box: approximate longitude is 080 W.

2. Refer to the equator crossing table and select an orbit within 20 degrees of the approximate longitude and within the appropriate time frame.

TIME (GMT)	E. LONGITUDE	ORBIT
day hr mn sc	deg.dg	
292 11 17 26	-6.52	1524
292 13 2 48	-32.99 •	1525
292 14 48 9	-59.45	1526
292 16 33 31	-85.92	1527
292 18 88 52	-112.38	1528

From the table there are two orbits that are within plus or minus 20 degrees of the route of flight; 1526 and 1527. Orbit #1526 is the earliest (1448Z) and is within our time frame.

3. Position the overlay at the selected longitude and determine if mutual visibility exists or will exist.

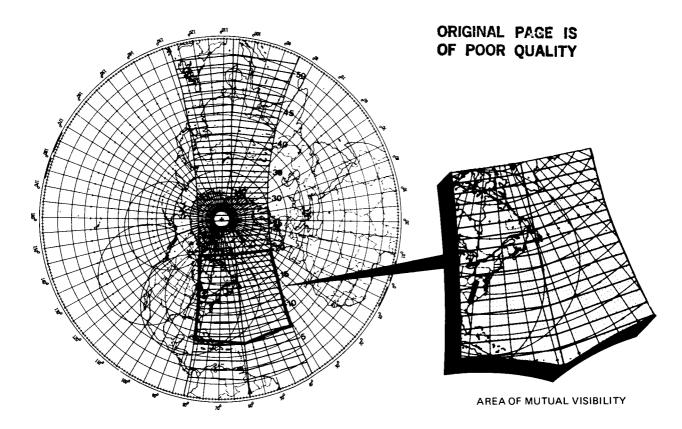


Figure 5

Remember, mutual visibility exists when the ELT/EPIRB is within the satellite antenna swath and the satellite subtrack is within a LUT circle. We can see that the ground track is within the LUT circle. Also, the route of flight we are interested in is within the antenna swath at the same time the ground track is within the LUT circle. Therefore, mutual visibility exists on orbit #1526.

CALENDAR 1984 DAYS OF WEEK AND DAYS OF THE YEAR

-	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1 2 3 4 5 6 7	SU 1 M 2 TU 3 W 4 TH 5 F 6 SA 7	W 32 TH 33 F 34 SA 35 SU 36 M 37 TU 38	TH 61 F 62 SA 63 SU 64 MO 65 TU 66	M 93 TU 94 W 95 TH 96 F 97	TU 122 W 123 TH 124 F 125 SA 126 SU 127 M 128	F 153 SA 154 SU 155 M 156 TU 157 W 158 TH 159	SU 183 M 184 TU 185 W 186 TH 187 F 188 SA 189	W 214 TH 215 F 216 SA 217 SU 218 M 219 TU 220	SA 245 SU 245 MO 246 TU 247 W 248 TH 249 F 250	M 275 TU 276 W 277 TH 278 F 279 SA 280 SU 281	TH 306 F 307 SA 308 SU 309 M 310 TU 311 W 312	SA 336 SU 337 MO 338 TU 339 W 340 TH 341 F 342
8 9 10 11 12 13	SU 8 M 9 TU 10 W 11 TH 12 F 13 SA 14	W 39 TH 40 F 41 SA 42 SU 43 M 44 TU 45	TH 68 F 69 SA 70 SU 71 M 72 TU 73 W 74	SU 99 M 100 TU 101 W 102 TH 103 F 104	TU 129 W 130 TH 131 F 132 SA 133 SU 134 M 135	F 160 SA 161 SU 162 M 163 TU 164 W 165 TH 166	SU 190 M 191 TU 192 W 193 TH 194 F 195 SA 196	W 221 TH 222 F 223 SA 224 SU 225 M 226 TU 227	SA 251 SU 252 M 253 TU 254 W 255 TH 256 F 257	M 282 TU 283 W 284 TH 285 F 286 SA 287 SU 288	TH 313 F 314 SA 315 SU 316 M 317 TU 318 W 319	SA 343 SU 344 M 345 TU 346 W 347 TH 348 F 349
15 16 17 18 19 20 21	SU 15 M 16 TU 17 W 18 TH 19 F 20 SA 21	W 46 TH 47 F 48 SA 49 SU 50 M 51 TU 52	TH 75 F 76 SA 77 SU 78 M 79 TU 80 W 81	M 107 TU 108 W 109 TH 110	TU 136 W 137 TH 138 F 139 SA 140 SU 141 M 142	F 167 SA 168 SU 169 M 170 TU 171 W 172 TH 173	SU 197 M 198 TU 199 W 200 TH 201 F 202 SA 203	W 228 TH 229 F 230 SA 231 SU 232 M 233 TU 234	SA 258 SU 259 M 260 TU 261 W 262 TH 263 F 264	M 289 TU 290 W 291 TH 292 F 293 SA 294 SU 295	TH 320 F 321 SA 322 SU 323 M 324 TU 325 W 326	SA 350 SU 351 M 352 TU 353 W 354 TH 355 F 356
22 23 24 25 26 27 28	SU 22 M 23 TU 24 W 25 TH 26 F 27 SA 28	W 53 TH 54 F 55 SA 56 SU 57 M 58 TU 59	TH 82 F 83 SA 84 SU 85 M 86 TU 87 W 88	M 114 TU 115 W 116 TH 117 F 118	TU 143 W 144 TH 145 F 146 SA 147 SU 148 M 149	F 174 SA 175 SU 176 M 177 TU 178 W 179 TH 180	SU 204 M 205 TU 206 W 207 TH 208 F 209 SA 210	W 235 TH 236 F 237 SA 238 SU 239 M 240 TU 241	SA 265 SU 266 M 267 TU 268 W 269 TH 270 F 271	M 296 TU 297 W 298 TH 299 F 300 SA 301 SU 302	TH 327 F 328 SA 329 SU 330 M 331 TU 332 W 333	SA 357 SU 358 M 359 TU 360 W 361 TH 362 F 363
29 30 31	SU 29 M 30 TU 31	w 60	TH 89 F 90 SA 93	M 121	TU 150 W 151 TH 152	F 181 SA 182	SU 211 M 212 TU 213	W 242 TH 243 F 244	SA 272 SU 274	M 303 TU 304 W 305	TH 334 F 335	SA 364 SU 365 M 366

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Satellite C1			Satellite C2			Sate	Satellite S1			
TIME (GMT) day hr mn sc	E. LONG. deg.dg	ORBIT	TIME (GMT) day hr mn sc	E. LONG. deg.dg	ORBIT	TINE (GNT) day hr mn sc	E. LONG. deg.dg	ORBIT		
112 00:04:32 112 01:49:53 112 03:35:14 112 05:20:36 112 08:51:19 112 108:56:40 112 12:22:01 112 14:07:23 112 17:38:05 112 17:38:05 112 17:38:27 112 17:23:27 112 17:23:27	-62.47 -88.94 -115.41 -141.83 -165.20 138.27 112.27 -159.34 32.88 -6.41 -20.05 -46.52	9037 9038 9039 9040 9041 9042 9044 9045 9048 9049 9050	112 00:25:48 112 02:10:41 112 03:55:34 112 05:48:26 112 07:10:12 112 07:10:12 112 14:24:51 112 14:24:51 112 16:09:44 112 17:39:29 112 21:24:22 112 23:09:15	17.61 -8.74 -35.08 -61.438 -114.12 -140.47 -166.84 140.50 114.15 87.80 61.46 35.11	53967 53978 53978 53978 53979 5401 54405 54405 54408 54408	112 00:04:56 112 01:46:14 112 03:27:31 112 05:08:49 112 05:08:31:25 112 10:35:18:36:36:12:13:35:18 112 13:35:18:36:12:16:36:12:16:36:12:16:36:112:16:36:112:16:22:23:43:05	-66.8124 -117.447 -1428.955 -141.56.294 -1428.955 -141.56.39 -146.68 -136.33 -136.33	55555555555555555555555555555555555555		
113 00:39:31 113 02:24:52 113 04:10:14 113 05:55:35 113 07:40:57 113 09:26:18 113 11:11:39 113 12:57:01 113 14:42:22 113 16:27:44 113 18:13:05 113 19:58:26 113 23:29:09	-72.98 -99.45 -125.38 -178.84 -154.69 128.23 -101.77 -48.84 -22.37 -4.10 -30.56	9051 9053 9053 9055 9055 9055 9066 9066 9066 9066 9066	113 00:54:08 113 02:39:81 113 04:23:54 113 06:08:46 113 07:53:39 113 09:38:32 113 11:28:18 113 14:53:11 113 16:38:04 113 18:22:56 113 20:07:49 113 21:52:42 113 23:37:35	8.77 -17.58 -43.93 -70.62 -122.31 -175.66 158.65 105.31 78.61 78.61	5411234 5411234 5411234 54114 54116	113 01:24:23 113 03:05:46:58 113 04:46:58 113 06:28:34 113 09:50:51 113 11:32:09 113 13:13:27 113 14:54:45 113 16:36:03 113 19:58:38 113 21:39:56 113 21:39:56	-86.667 -111.333 -162.663 -172.673 -162	55555555555555555555555555555555555555		
114 20:33:26	-83.49 -109.95 -136.42 -162.88 170.65 144.19 117.72 91.26 64.33 11.86 -14.60	9065 90667 90648 9069 9071 9072 9073 9077 9077	114 01:22:28 114 03:07:21 114 04:52:14 114 06:37:06 114 10:06:52 114 11:51:45 114 13:36:38 114 17:06:24 114 18:51:16 114 20:36:09 114 22:21:02	43.77	54256789901233455555555555555555555555555555555555	114 01:02:31 114 02:43:49 114 04:25:07 114 06:06:25 114 07:47:42 114 01:10:18 114 12:51:36 114 14:32:54	-81.18	5544 55645 55667 55669 5571 5571 5574 5576 5577		
115 00:04:09 115 01:49:30 115 03:34:51 115 05:20:13 115 07:05:34 115 08:50:55 115 10:36:17 115 12:21:38 115 14:07:00 115 17:37:42 115 17:37:42 115 19:23:04 115 21:08:25	-67.53 -94.60 -120.46 -146.93 -173.39 -160.14 133.68 107.21 -51.57	9079 9070 9081 9088 90884 90884 9088 9088 9089 9091	115 00:05:55 115 00:05:50:48 115 003:35:41 115 007:20:34 115 008:50:19 115 10:35:12 115 10:35:12 115 14:04:58 115 17:34:44 115 17:19:49:21	17.43 -8.26 -35.26 -61.96 -114.30 -140.65 -166.66 140.31 113.92 61.27 34.93	5436 5437 5438 54441 54442 54445 54445 54445 54449	115 00:40:40 115 02:21:58 115 04:03:16 115 05:44:34 115 07:25:51 115 07:07:07:07:07:07:07:07:07:07:07:07:07:0	-75.72 -101.05 -126.37 -151.70 -177.66 1327.06 137.06 137.06 101.76 101.	5578 5579 5581 5582 5583 5584 5584 5586 5587 5588 5589 5591		

Satellite C1	Satellite C2			Sate	Satellite S1		
TIME (GMT) E. LGNG day hr wn sc deg.dg	. ORBIT	TIME (GMT) day hr mn sc	E. LONG. deg.dg	ORBIT	TIME (GMT) day hr mn sc	E. LONG. deg.dg	ORBIT
-78.04 -78.04 -104.51 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -134.57 -135.62 -135.62 -136.23 -23.28 -62.08	9993 98994 9895 98967 9898 9101 9101	116 00:34:15 116 02:19:08 116 02:19:08 116 05:48:54 116 07:33:47 116 07:18:39 116 11:43:32 116 12:48:25 116 14:33:18 116 16:18:11 116 18:43:18 116 18:43:18	9.58 -17.6 -44.11 -76.45 -123.15 -149.49 -175.84 131.47 131.47 131.47 131.47 131.47 131.47 131.47	545123 54523 5452 5452 5452 5452 5452 5452 5	116 09:18:49 116 02:00:25 116 03:41:25 116 05:22:42 116 07:24:10 116 08:45:18 116 10:267:53 116 13:47:11 116 15:30:29 116 17:11:47 116 18:53:05 116 20:34:22 116 22:15:40 116 23:56:58	-70.26 -95.58 -120.91 -146.22 -171.55 163.12 137.80 112.48 87.15 51.83 36.50 11.17 -14.14 -39.47 -64.79	5592 5593 5594 5597 5599 5599 5599 5599 5560 5600 5600 5600
-88.55 -17 02:59:29 -115.01 -17 04:44:50 -141.48 -17 06:30:12 -167.94 -17 08:55 -12 16:59 -13:13:31:37 -13:16:59 -17:15:16:59 -17:17:02:20 -17:18:47:41 -18:47:41 -18:47:41 -19:48 -19:66 -19:66 -19:66 -19:66 -19:66 -19:66	9107 9108 9110 9111 91112 91113 91115 9117	117 01:02:35 117 02:47:28 117 04:47:14 117 06:17:14 117 08:02:07 117 11:31:52 117 13:16:45 117 15:01:38 117 16:46:31 117 18:31:24 117 20:16:17 117 22:01:10 117 23:46:02	26.05 -52.30 -105.699 -131.33 -158.33 -158.33 -158.33 -175.28 -175.28 -175.28	5464 5466 5466 5466 5468 5472 5472 5472 5474 5477 5477	117 01:38:16 117 03:19:33 117 05:00:51 117 06:42:09 117 08:23:27 117 10:04:45 117 11:46:02 117 13:27:20 117 16:49:56 117 18:31:13 117 20:12:31 117 21:53:49 117 23:35:07	-90 12 -115 43 -140 09 -168 59 -168 59 -143 29 -117 95 -29 -41 65 -8 68 -34 00	789011234567890 566011234567890 56611234567890
18 14 03 : 46 -72 59 18 13 49 : 07 -99 : 05 18 13 34 : 28 -125 : 52 110 5 : 19 : 50 -151 : 98 12 15 : 11 -178 : 45 13 15 : 54 : 128 : 62 14 15 : 55 : 58 15 : 58 : 58 : 49 : 23 16 17 : 37 : 19 17 : 19 18 17 : 19 18 17 : 19 18 17 : 19 18 17 : 19 18 18 : 18 : 02 -30 : 17 18 22 : 53 : 24 -56 : 63	9112545 9112545 911225 91122 91123 9113 9113 913	118 01:30:55 118 03:15:48 118 05:00:41 118 06:45:34 118 08:30:27 118 10:10:12 118 13:45:15 118 13:45:15 118 17:14:51 118 18:59:44 118 20:44:37 118 22:29:30	-9.10 -35.45 -61.79 -88.14 -14.48 -87.18 -87.18 -87.18 -87.18 -87.18 -87.18 -87.44 -61.09 -34.75	5478 5479 5482 5482 5482 5482 5486 5486 5486 5486 5486 5486 5486 5486	118 01:16:25 118 02:57:42 118 04:39:80 118 06:20:18 118 08:01:36 118 09:42:51 118 11:25:29 118 14:46:47 118 16:28:05 118 18:09:22 118 19:50:40 118 21:31:58 118 23:13:16	-84.66 -109.97 -135.30 -160.62 174.05 148.74 128.76 47.43 22.11 -28.87 -28.87	5621 56223 56223 56224 56227 56227 56229 56230 56331 56333 56333
19	9133 9135 9135 9135 9133 9133 9144 9144 9144 9144 9144	119 00:14:23 119 01:59:15 119 03:44:08 119 05:29:01 119 07:13:54 119 08:58:47 119 10:43:40 119 12:28:33 119 14:13:28 119 15:58:18 119 17:43:11 119 21:12:57 119 22:57	8.48 -17.94 -44.29 -70.64 -96.98 -123.33 -149.62 157.62 157.62 157.62 151.29 104.60 525.91	5492 5492 5492 5494 55495 55498 5550 5550 5550 5550 5550 5550 5550 55	119 00:54:33 119 02:35:51 119 04:17:09 119 05:58:27 119 07:39:44 119 09:21:02 119 11:02:20 119 12:43:38 119 14:24:56 119 16:06:13 119 17:47:31 119 19:28:49 119 21:10:07 119 22:51:24	-79 18 -104 51 -129 83 -155 16 179 53 154 87 103 52 128 91 27 28 -23 07 -48	5635 56337 56337 56339 5643 56441 56445 56446 56446 56446 56446 56446 56446

Satellite C1		Satellite C2			Satellite S1			
TIME (GNT) E. LONG day hr wn sc deg.dg	. ORBIT			ORBIT	TIME (GMT) day hr mn sc	E. LONG. deg.dg	ORBIT	
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Sate	llite C1		Satellite C2			Sate	Satellite S1		
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Satellite C2

Satellite S1

West longitude is negative (-).

Satellite C1

Satellite C1		Satell	ite C2		Satellite S1		
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154 01:44:32 -159.75 154 03:29:53 173.78 154 05:15:15 147.32 154 07:00:36 120.85 154 08:45:58 94.39 154 10:31:19 67.92 154 12:16:40 41.46 154 14:02:02 14.99 154 15:47:23 -11.47 154 17:32:44 -37.94 154 19:18:06 -64.40 154 21:03:27 -90.87 154 22:48:49 -117.33	9614 9615 9616 9617 9618 9619 9621 9622 9622 9624	154 01:82:19 154 02:47:12 154 04:32:85 154 06:16:58 154 08:01:50 154 09:46:43 154 11:31:36 154 13:16:29 154 15:01:22:154 154 16:46:15 154 16:46:15 154 22:00:54 154 23:45:46	-46.51	5972 5973 5975 5976 5977 5978 5988 5988 5988 5988 5988	154 81:40:04 154 03:21:22:154 154 05:82:48 154 08:25:15 154 10:06:33 154 11:47:51 154 13:27:07 154 13:27:02 154 16:51:44 154 18:33:02 154 21:55:37 154 23:36:55	-90.47 -115.12 -141.12 -146.45 168.24 142.59 -34.25 -59.68 -59.68	5133 6135 6135 6137 6138 6138 6141 6143 6144 6145
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Satellite C1		Satel	lite C2		Satellite S1		
TIME (GMT) E. LONG. day hr mn sc deg.dg	ORBIT	TIME (GMT) day hr mn sc	E. LONG. deg.dg	ORBIT	TIME (GMT) day hr mn sc	E. LONG. deg.dg	ORBIT
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Sate	illite C1		Satel	lite C2		Sate	ollite S1	
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171 01:07:12 171 02:52:33 171 04:37:54 171 06:23:16 171 08:08:37 171 09:53:59 171 11:39:20 171 13:24:41 171 15:10:03 171 16:55:24 171 18:40:45 171 20:26:07 171 22:11:28 171 23:56:49	-179.58 153.95 127.49 101.03 74.56 48.10 -1.63 -31.376 -31.376 -137.16 -163.62	98445 98445 98447 98447 98855 98855 98855 98855 98855 98855 98855	171 08:19:41 171 02:04:33 171 03:49:25 171 05:34:19 171 07:19:12 171 09:04:05 171 10:48:58 171 12:33:51 171 14:18:44 171 15:48:29 171 17:48:29 171 21:18:15 171 23:63:08	-82.637 -168.337 -135.67 -135.699 -145.305 -145.305 -145.305 -128.73 -138.73 -138.73 -138.73 -138.73	620078901123622118622118622118	171 00:32:25 171 02:13:43 171 03:55:00 171 05:36:18 171 07:17:36 171 08:58:54 171 10:40:11 171 12:21:47 171 15:44:05 171 17:15:47 171 17:25:40 171 17:26:47 171 20:47:58 171 22:27	-73.51 -98.84 -124.15 -149.81 -174.81 -174.81 -174.87 -134.55 109.23 -17.39 -42.72	6374 6375 6377 63778 6379 6381 6382 6383 6383 6387

Sate	ellite C1		Satel	lite C2		Sate	ellite S1	
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Satellite S1

West longitude is negative (-).

Satellite C1

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ORIGINAL PAGE IS

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West longitude is negative (-).					

Satellite C2

Satellite S1

West longitude is negative (-).

Satellite C1

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Satellite C2

Satellite S1

West longitude is negative (~).

Satellite C1

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Satellite C1			Satellite C2			Satellite S1		
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4. Title and Subtitle COSPAS-SARSAT		5.	5. Report Date March 1984		
SATELLITE ORBIT PREDI VOLUME III	CTOR	6.	Performing Organia	zation Code	
7. Author(s) Morton L. Friedm and Major James			Performing Organia	zation Report No.	
9. Performing Organization Name an			. Work Unit No.		
NASA Goddard Space Fligh	t Center	1	. Contract or Grant		
Greenbelt, Maryland 20771		''	i No.		
		13.	. Type of Report a	nd Period Covered	
12. Sponsoring Agency Name and A National Aeronautics and S		on	Technical Mem	orandum	
Washington, DC 20546		14	. Sponsoring Agend	cy Code	
Major James "Bill" Garrett 16. Abstract An analog aid to determine				e.	
17. Key Words (Selected by Author	(s))	18. Distribution Statement			
SARSAT orbit predictor	Unclassified — Unlimited				
		Subject Category 15			
19. Security Classif. (of this report)	20. Security Class	if. (of this page)	21. No. of Pages	22. Price*	
Unclassified	Unclassified	1	58	A04	
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